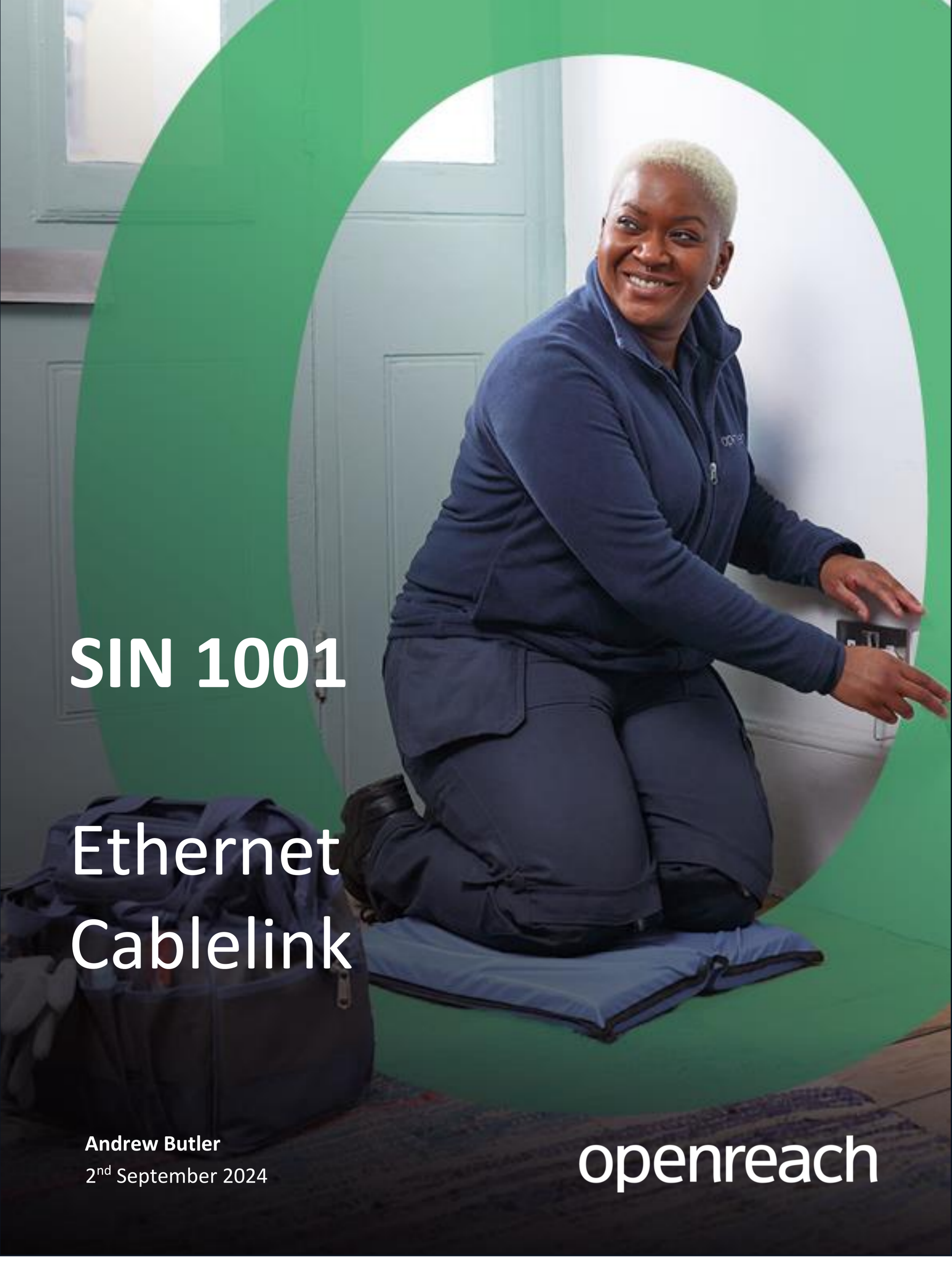


SIN 1001

Ethernet Cablelink

Andrew Butler
2nd September 2024

openreach

Ethernet Cablelink (EBCL)

Service & Interface Description

Revisions

S/N	Version	Author	Date	Description
1	Issue 1.0	Passive Products Team	Jan 2021	First issue
2	Issue 1.1	Passive Products Team	Feb 2021	Amendment to Optical Safety paragraph to align with SIN525 (DFX)
3	Issue 1.2	Passive Products Team	May 2021	Amendment to accommodate new high fibre count options for the Internal & External variants
4	Issue 1.3.1	Passive Products Team	Mar 2022	Amendment to accommodate new COF401 Internal Cable, stop sell of 48 Fibre Cell Site Variant and inclusion of PIA reference as external cable label.
5	Issue 1.4	Passive Products Team	Jun 2022	Additions to support removal of CP1 & CP2 as well as amendments to support the migration to EMP.
6	Issue 1.4.1	Passive Products Team	Oct 2022	Added link to Bi-directional Test results template
7	Issue 2.0	Passive Products Team	Feb 2023	Updated Branding, Support for Ribbon Cable and new Splicing Schedule template
8	Issue 2.1	Passive Products Team	May 2023	Support for Corrugate Steel Tape Cable
9	Issue 2.2	Passive Products Team	Oct 2023	Removal of Support for Ribbon Cable
10	Issue 2.2.1	Passive Products Teams	Dec 2023	Support for <7mm diameter CP External Cable
11	Issue 2.3.1	Passive Product Team	Sept 2024	24 & 48 Port Optical Patching shelves

Each SIN is the copyright of British Telecommunications plc. Reproduction of the SIN is permitted only in its entirety, to disseminate information on the Openreach Network within your organisation. You must not edit or amend any SIN or reproduce extracts. You must not remove Openreach trademarks, notices, headings, or copyright markings.

Users of this document should not rely solely on the information in this document but should carry out their own tests to satisfy themselves that terminal equipment will work with the Openreach network.
Openreach reserves the right to amend or replace any or all of the information in this document.
Openreach shall have no liability in contract, tort or otherwise for any loss or damage, howsoever arising from use of, or reliance upon, the information in this document by any person.
Due to technological limitations, a very small percentage of customer interfaces may not comply with some of the individual characteristics, which may be defined in this document.
Publication of this Suppliers' Information Note does not give or imply any licence to any intellectual property rights belonging to British Telecommunications plc or others. It is your sole responsibility to obtain any licences, permissions or consents which may be necessary if you choose to act on the information supplied in the SIN.

Those Openreach services marked ⍰⍰indicates it is a registered trademark of British Telecommunications plc.
Those Openreach services marked ⍰⍰indicates it is a trademark of British Telecommunications plc.

This SIN is available in Portable Document Format (pdf) from:
https://www.openreach.co.uk/orpg/home/helpandsupport/sins/sins.do

Enquiries relating to this document should be directed to: orsinsfa@openreach.co.uk

Table of Contents

1. **Introduction** 5
2. **Product Overview** 5
3. **Cables used by Openreach** 6
3.1. **Cables for Installation in Underground Ducts** 6
3.1.1. **COF200 – Loose Tube** 6
3.1.2. **COF800 – Incrementally Bonded Ribbon** 8
3.2. **Cable for Installation within an Exchange** 9
3.2.1. **COF401 – Strategic Internal Cable** 9
4. **Communication Provider's external optical fibre cable** 11
4.1. **Minimum Cable Specification** 12
4.2. **Cable Entering an Exchange** 12
4.3. **Cable Labelling & Sheath Markings** 13
4.4. **Cable Jointing** 14
4.5. **Splicing Schedules** 14
5. **Internal Cable Termination Options** 15
5.1. **Coiled Cable** 15
5.2. **Optical Patching Shelves** 15
6. **Optical Fibre Acceptance Testing** 15
6.1. **Testing Connectivity** 16
6.2. **Splice Loss Estimation** 16
7. **Optical Safety** 16
8. **Appendices** 17
8.1. **Optical Fibre Presentation** 17
8.2. **COF950 – discontinued internal cable** 18
8.3. **Corrugated Steel Tube Cable diagram** 20
9. **References** 20
10. **Abbreviations** 21

1. Introduction

This Suppliers' Information Note (SIN) is an Openreach ancillary document. It contains important information about the Cablelink product which our customers ("you") need to understand.

As we introduce or withdraw product features, or otherwise develop our services, we will make changes to this document in line with the change process for ancillary documents in our product contracts.

Cablelink is a product with three internal, one external fibre link and one cell site option to allow connectivity into the Openreach infrastructure and BT Exchanges.

This document provides a summary of information relating to the Ethernet Cablelink product only and does not refer to GEA Cablelink.

2. Product Overview

The Ethernet Cablelink product suite connects your equipment within a Licensed Facility to your network, or between two spaces within the same building which are not next to each other.

There are four variants of the Ethernet Cablelink product: one external variant, three internal variants and a Cell Sites variant, providing Exchange based network connection solutions for CP's equipment and their network requirements.

Internal Variant 1 offers the ability for a CP to connect two Licensed Facilities together, whether they are owned by the same CP or connecting to another. These can be provided in sizes of 12, 24 or 48 fibre.

Internal Variant 3 offers the ability for a CP to utilise spare fibres from an existing externally gifted cable, which resides within the Cable Chamber of the exchange, and terminate a new internal fibre to a licensed facility. These can be provided in sizes of 12, 24 or 48 fibre.

External Variant offers the ability for a CP to install a new external fibre into an exchange and terminate some, or all, of the fibres into a licenced facility. Spare fibres can be utilised later via Internal Variant 3. Internal Cable sizes can be sizes of 12, 24, 48, 96, 144 or 288 depending on the size of the external to be provided, 24, 48, 96, 144 or 288. Product rules can be found in the Product Description.

Cell Site Variant offers the ability for a CP to connect a 24-fibre cable between a CP owned Cell Site, located within the Exchange Curtilage or the rooftop of the Exchange, to a licensed facility within the exchange.

Termination options at the Licensed Facility end of the Ethernet Cablelink service are provided as either an Optical Patch Panel or as a Coiled Cable.

Exchange handover location is typically the Openreach Exchange Handover Box, however, with the introduction of Openreach Physical Infrastructure Access (PIA), an alternative point of handover could be the Exchange manhole, where a CP is established to use PIA duct.

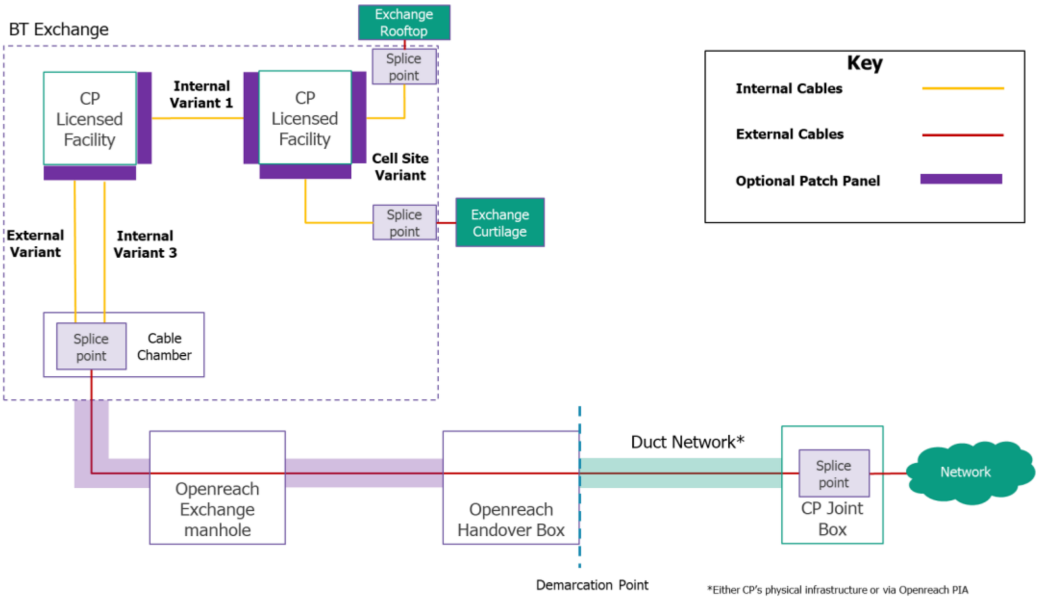

BT Exchange
Exchange Rooftop
Splice point
CP Licensed Facility
Internal Variant 1
CP Licensed Facility
Cell Site Variant
Splice point
Exchange Curtilage
External Variant
Internal Variant 3
Splice point
Cable Chamber
Key
Internal Cables
External Cables
Optional Patch Panel
Duct Network*
Openreach Exchange manhole
Openreach Handover Box
Splice point
CP Joint Box
Network
Demarcation Point
*Either CP's physical infrastructure or via Openreach PIA

Figure 1 - Ethernet Cablelink Schematic Diagram

3. Cables used by Openreach

This section provides a summary of the Optical Fibre Cable that are used by Openreach and can be used by CPs for this product. These are shown in the following subsections, which are split into Openreach Cable Optical Fibres (COF) (external and internal).

3.1. Cables for Installation in Underground Ducts

Two different types of external cable for installation in underground ducts and limited internal length to a transition node can be used

COF200 is the standard for Loose Tube cable and COF800 is the standard for incrementally bonded ribbon fibre. Section 3.1.1 and section 3.1.2 provide a summary of the 2 cable types.

3.1.1. COF200 – Loose Tube

Cable Element / Detail	COF200
Number of fibres in cable	12 to 288 fibres in 12 fibre elements
Fibre Type	The cables contain primary coated single mode optical fibres in accordance with ITU-T Recommendation G.657.A
Strength Member	Glass Reinforced Plastic. Coated in black polyethylene of a suitable grade.
Stranded Layer (elements stranded around strength member)	1 to 12 polymeric tubes of a maximum outside diameter of 2.0mm, each containing 12 colour coded fibres and Gel type water blocking compound. Polymeric dummy tubes (where necessary).

Optical Fibre Identification	The fibres in each tube are coloured for identification purposes. The fibres are coloured in accordance with Table 5 of this SIN
Loose Tube Identification	The colour scheme used for the loose tubes can be seen in Table 6 of this SIN.
Water blocking materials within interstices of Stranded Layer	Water swellable threads / tapes materials present.
Binder Layer (material surrounding stranded layer)	Threads and / or tapes of typically polyester, water swellable material etc.
Ripcords	Two, laid over the binder layer.
Cable Sheath Construction	Black polyethylene sheath of a suitable grade. This will have a minimum diameter of 1.00mm and elements within shall not produce a corrugation effect on the sheath.
Cable Outside Diameter	12mm to 13.5mm (single layer construction)
Cable Jointing	The fibres are jointed using fusion splicing techniques. The cable joint closure (where applicable) is installed to the cable sheath using either mechanical or heat shrink techniques.

Table 1 - COF 200 properties (external cable)

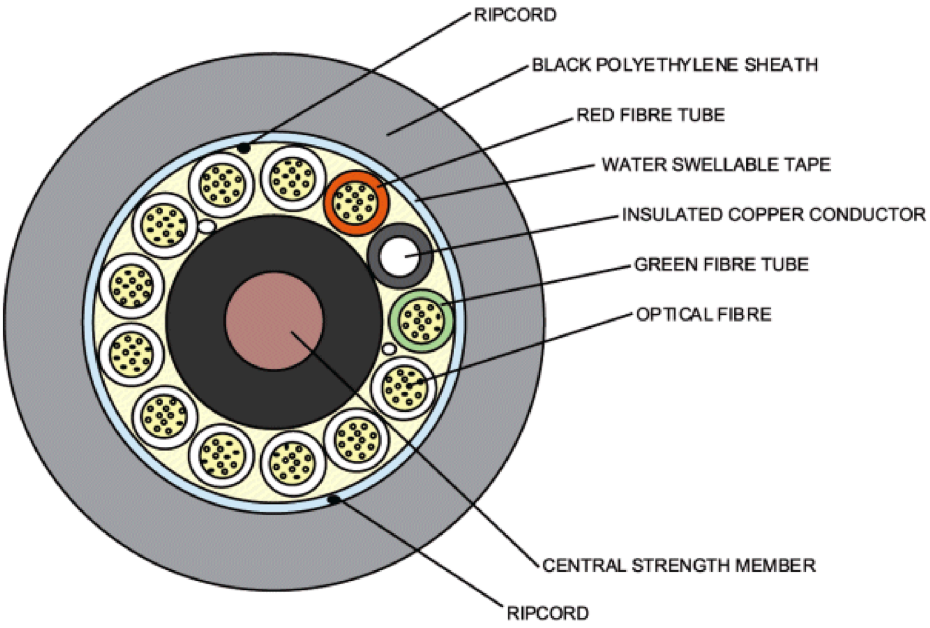

RIPCORD
BLACK POLYETHYLENE SHEATH
RED FIBRE TUBE
WATER SWELLABLE TAPE
INSULATED COPPER CONDUCTOR
GREEN FIBRE TUBE
OPTICAL FIBRE
CENTRAL STRENGTH MEMBER
RIPCORD

Figure 2 - COF200 144 Fibre

3.1.2. COF800 – Incrementally Bonded Ribbon

Cable Element / Detail	**COF800**
Number of fibres in cable	144 or 288 fibres in 12 fibre elements. Pitch spacing between the fibres within the ribbon array shall be 250µm.
Fibre Type	The fibres shall be incrementally bonded relative to one another, i.e. they shall not be bonded continually along their length. They shall be easily separated from each other The cables contain primary coated single mode optical fibres in accordance with ITU-T Recommendation G.657.A
Strength Member	Non-metallic strength members within the cable construction. The Cable shall be sheathed in black polyethylene of a suitable grade.
Optical Fibre Identification	The fibres in each ribbon are coloured for identification purposes. Openreach uses the colour code accordance with Table 5 of this SIN
Ribbon Identification	Each ribbon shall be uniquely marked to aid identification as part of the cable jointing process
Water blocking materials within interstices of Stranded Layer	The cable core shall contain dry materials to prevent the longitudinal flow of water
Binder Layer (material surrounding stranded layer)	Threads and / or tapes of typically polyester, water swellable material etc.
Ripcords	Two, laid over the binder layer.
Cable Sheath Construction	Black polyethylene sheath in accordance with BS EN 50290-2-24. The cable sheath thickness shall be a minimum of 2.00mm
Cable Outside Diameter	12mm to 25mm
Cable Jointing	The fibres are jointed using fusion splicing techniques. The cable joint closure (where applicable) is installed to the cable sheath using either mechanical or heat shrink techniques.

Table 2 - COF 800 properties (external ribbon cable)

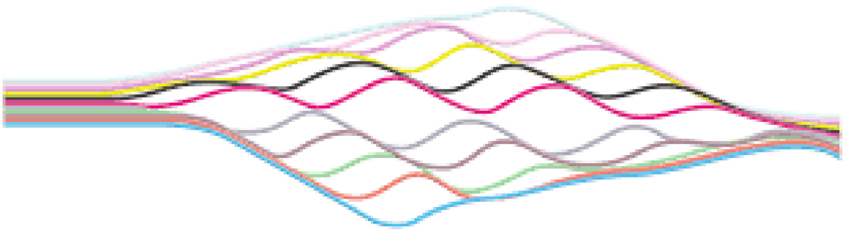


Figure 3 - 12 incrementally bonded fibres

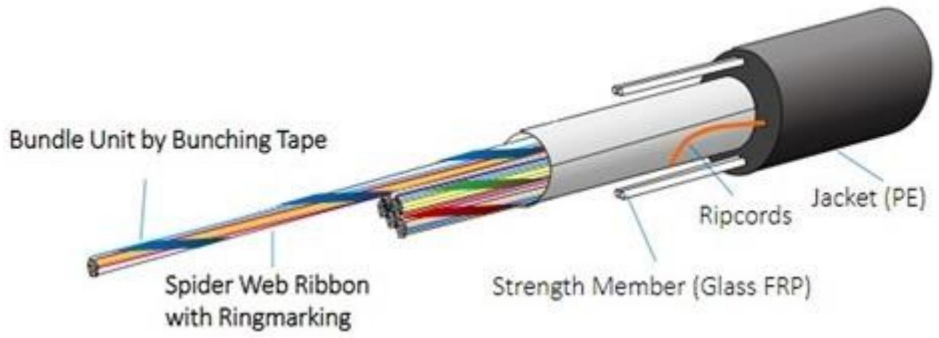

Bundle Unit by Bunching Tape
Spider Web Ribbon with Ringmarking
Strength Member (Glass FRP)
Ripcords
Jacket (PE)

Figure 4 - Incrementally bonded ribbon cable

3.2. Cable for Installation within an Exchange

Internal cables are designed for installation in buildings only and must have a minimum fire performance classification of Cca s1b, d1, a2. Openreach uses COF401 for this purpose. Section 3.1.1 provides a summary of the cable.

3.2.1. COF401 – Strategic Internal Cable

	12F	24F	48F	96F	144F
Central Strength Member	1.5mm glass reinforced plastic (GRP)			2.85mm glass reinforced plastic (GRP)	4.55mm glass reinforced plastic (GRP)
Optical Fibre	The cables contain primary coated single mode optical fibres in accordance with ITU-T Recommendation G.657.A.				
Optical Fibre Identification	The fibres in each tube are coloured for identification purposes. The fibres are coloured in accordance with Table 5 of this SIN.				
Stranded Layer (elements stranded around central strength member)	1 polymeric ‘easy peel’ blue tube containing 12 colour-coded fibres. The tube is ‘dry’, i.e. do not contain Gel type water blocking compound. There are 4	2 polymeric ‘easy peel’ tubes (blue and orange) containing 12 colour-coded fibres. The tubes are ‘dry’. There are 3 Polymeric dummy tubes.	4 polymeric ‘easy peel’ tubes (blue, orange, green, red) containing 12 colour-coded fibres. The tubes are ‘dry’. There	8 polymeric ‘easy peel’ tubes (in BT colour code) containing 12 colour-coded fibres. The tubes are ‘dry’. There are no	12 polymeric ‘easy peel’ tubes (in BT colour code) containing 12 colour-coded fibres. The tubes are ‘dry’. There are no Polymeric dummy tubes.

	Polymeric dummy tubes.		IS 1 Polymeric dummy tubes.	Polymeric dummy tubes.	
Loose Tube Identification	The colour scheme used for the loose tubes can be seen in Table 4 of this SIN.				
Binder/Wrapping Layer (material surrounding stranded layer)	A layer of glass yarn fibres provide additional strength and further flame protection.				
Ripcords	A single rip cord is found under the sheath				
Water blocking materials within cable	No materials present				
Cable Sheath Construction	Yellow Ultra Low Smoke Zero Halogen flame-retardant thermoplastic material in accordance with BS EN 50290-2-27.				
Cable Sheath Marking	Markings to indicate optical telecommunications cable + the legend COF401XXXF (XXX = Number of fibres in cable).				
Nominal Cable Outside Diameter	6.7mm			8.5mm	10.5mm
CPR Fire Performance	The cables meet the fire performance requirements of BS EN 50575 with a minimum classification of Cca s1b, d1, a2.				
Cable Jointing	The fibres are jointed using fusion splicing techniques. The cable joint closure (where applicable) is installed to the cable sheath using either mechanical or heat shrink techniques.				

Table 3 - COF401 properties (Internal Cable)

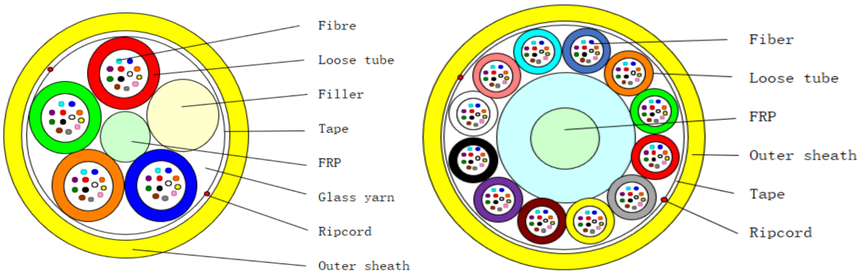
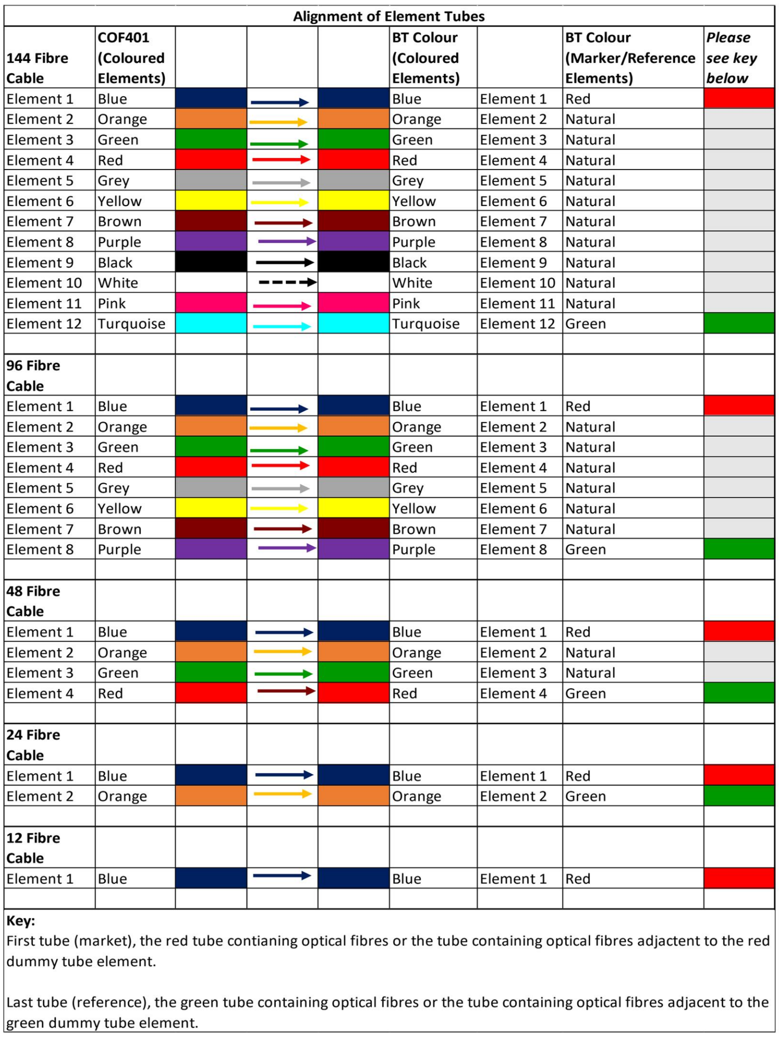


Figure 5 - COF401 48 Fibres (left) & 144 Fibres (right)



				Alignment of Element Tubes				
144 Fibre Cable	**COF401 (Coloured Elements)**				**BT Colour (Coloured Elements)**		**BT Colour (Marker/Reference Elements)**	***Please see key below***
Element 1	Blue	🟦	→	🟦	Blue	Element 1	Red	🟥
Element 2	Orange	🟧	→	🟧	Orange	Element 2	Natural	▨
Element 3	Green	🟩	→	🟩	Green	Element 3	Natural	▨
Element 4	Red	🟥	→	🟥	Red	Element 4	Natural	▨
Element 5	Grey	▨	→	▨	Grey	Element 5	Natural	▨
Element 6	Yellow	🟨	→	🟨	Yellow	Element 6	Natural	▨
Element 7	Brown	🟫	→	🟫	Brown	Element 7	Natural	▨
Element 8	Purple	🟪	→	🟪	Purple	Element 8	Natural	▨
Element 9	Black	⬛	→	⬛	Black	Element 9	Natural	▨
Element 10	White	⬜	⇢	⬜	White	Element 10	Natural	▨
Element 11	Pink	■	→	■	Pink	Element 11	Natural	▨
Element 12	Turquoise	■	→	■	Turquoise	Element 12	Green	🟩
96 Fibre Cable								
Element 1	Blue	🟦	→	🟦	Blue	Element 1	Red	🟥
Element 2	Orange	🟧	→	🟧	Orange	Element 2	Natural	▨
Element 3	Green	🟩	→	🟩	Green	Element 3	Natural	▨
Element 4	Red	🟥	→	🟥	Red	Element 4	Natural	▨
Element 5	Grey	▨	→	▨	Grey	Element 5	Natural	▨
Element 6	Yellow	🟨	→	🟨	Yellow	Element 6	Natural	▨
Element 7	Brown	🟫	→	🟫	Brown	Element 7	Natural	▨
Element 8	Purple	🟪	→	🟪	Purple	Element 8	Green	🟩
48 Fibre Cable								
Element 1	Blue	🟦	→	🟦	Blue	Element 1	Red	🟥
Element 2	Orange	🟧	→	🟧	Orange	Element 2	Natural	▨
Element 3	Green	🟩	→	🟩	Green	Element 3	Natural	▨
Element 4	Red	🟥	→	🟥	Red	Element 4	Green	🟩
24 Fibre Cable								
Element 1	Blue	🟦	→	🟦	Blue	Element 1	Red	🟥
Element 2	Orange	🟧	→	🟧	Orange	Element 2	Green	🟩
12 Fibre Cable								
Element 1	Blue	🟦	→	🟦	Blue	Element 1	Red	🟥

Key:

First tube (market), the red tube contianing optical fibres or the tube containing optical fibres adjactent to the red dummy tube element.

Last tube (reference), the green tube containing optical fibres or the tube containing optical fibres adjacent to the green dummy tube element.

Table 4 - COF401 loose tube element jointing arrangement

4. Communication Provider’s external optical fibre cable

CPs need to be aware of the following points, which contain requirements for CP obligations relating to the Cablelink product and which are critical to the successful installation of Cablelink:

- Minimum cable specification, as outlined in section 4.1 must be followed.
- Use of sub-duct – CPs will remove any sub-duct before their cable is introduced to the handover box, i.e. no sub-duct to be present in the handover box.
- Coiling cable in the handover box – for cable management purposes, the length of cable to be coiled should be as agreed at the Site Survey, i.e. sufficient to reach the Cable Chamber and to allow for splicing to the internal cable. CPs will not leave excessive cable coiled in the handover box.

- Cable labelling – CP cable will be correctly labelled with EBCL or PIANOI circuit reference, as outlined in section 4.3.
- CP must provide a valid Splicing Schedule that clearly identifies how each fibre/element should be spliced, see section 4.5.

4.1. Minimum Cable Specification

The minimum requirements that CPs external optical fibre cable shall meet for it to be connected to the Openreach Network are detailed in this section. The cable shall be of a robust construction and shall be suitable for installation in underground ducts. A cable similar to or the same as COF200 would be appropriate, unless otherwise specified within section 4.1.

- All the materials within the cable shall be in accordance with the latest COSHH regulations.
- The diameter of the cable shall be in the range of **7 to 25mm**.
- Each fibre element shall contain **12 fibres**.
- The cable shall contain primary coated single mode fibre in accordance with ITU-T Recommendation G.652 or G.657.A.

In addition to the COF200 cable, as outlined in section 3.1.1, Openreach also support the following types of cable:

- Corrugate Steel Tape Cable (CST) (See section 8.3)

Note: Incrementally bonded ribbon cables are **not** supported.

Note: Sub 7mm diameter cables are currently under review and **not** supported.

If you wish to use a cable type that is not explicitly highlighted within section 4.1, then an SOR needs to be raised with Openreach to review its viability. If an unsupported cable is dropped, the order will be put into delay until resolved. Please see the Ethernet Cablelink Product Description for further details.

4.2. Cable Entering an Exchange

The external cable is only permitted to be routed from the underground duct network infrastructure, through the bulkhead duct seal and into the cable chamber of the BT Building.

The cable shall be cut in the cable chamber of the BT Building and jointed to a cable designed for internal use, see section 2.2 for more information.

The cable design shall permit the fitting / provision of a gas block. The gas block shall be fitted to the cable end in the cable chamber. The cable owner shall provide a works practice and confirm that their cable is suitable for use with 10B Closure Sealant Kit. The materials for the gas block shall meet the latest COSHH regulations.

Whether an Openreach handover box or the Exchange manhole is utilised, consideration will need to be given to ensure that there is sufficient capacity for the CP's external cable to be left coiled. Typically, the distance from point of handover to the Exchange manhole is no more than 100 meters, however there are cases where this is longer. In all cases this should be agreed at the point of joint site survey.

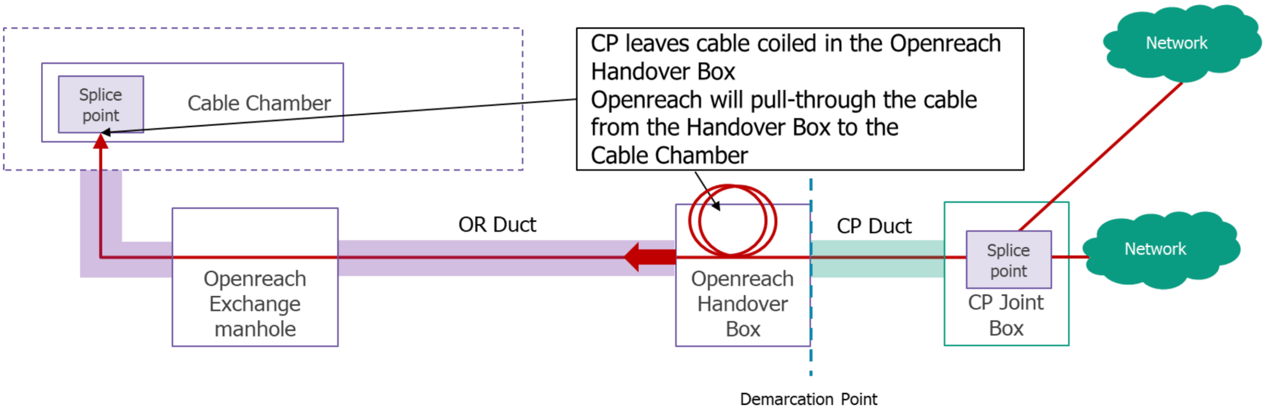

Splice point
Cable Chamber
CP leaves cable coiled in the Openreach Handover Box
Openreach will pull-through the cable from the Handover Box to the Cable Chamber
Network
OR Duct
CP Duct
Splice point
Network
Openreach Exchange manhole
Openreach Handover Box
CP Joint Box
Demarcation Point

Figure 6 - Typical cable drop topology

4.3. Cable Labelling & Sheath Markings

Optical fibre cables may be printed with manufactures generic sheath marking such as the supplier's name, date of manufacture, length marking, etc. and optionally your name. Optical fibre cables should not be printed with BT identification markings or a customer name other than that of the customer dropping the cable.

CPs must attach a label to optical fibre cables with your name and Order reference in all Openreach Handover boxes and Exchange Manholes. In large chambers it is recommended that additional labels are fitted to aid identification.

CPs will ensure that an appropriate label is attached to the external cable gifted to Openreach, at the cable end and at, or close to, the duct entry point of the handover box or exchange manhole.

CPs should use the EBCL reference of the Ethernet Cablelink order, however, in the case of Passive Infrastructure Access (PIA) supplied cables, the PIA Notice of Intent (NOI) order reference is an acceptable alternative if the following criteria are met:

- The CP is already an established customer for PIA and can place NOI orders.
- The PIA reference is provided within the dedicated field available at the point of order submission.

Only one cable can be dropped into the handover box or exchange manhole at a time. This is to ensure there is no duplication of Cable Reference amongst multiple orders.

Note that no changes to the PIA NOI reference label will be accepted after order received KCI is sent.

Accepted formats are:

- EBCL123456
- PIANOI123456789012

4.4. Cable Jointing

It shall be possible to joint the fibres using fusion splicing techniques.

It shall be possible to install the cable joint closure to the cable using either mechanical or heat shrink techniques without damage to the component parts of the cable.

At the point of connection, Openreach personnel or Contractors will joint the CP cable to the Openreach internal cable in accordance with the CP supplied Splicing Schedule, see section 3.4.

4.5. Splicing Schedules

For any Ethernet Cablelink order where an external cable owned by a CP is used, the CP must provide a Splicing Schedule

A Splicing Schedule should contain the following information:

- The CP Element and Fibre colour code
- The Openreach Colour Code
- The Fibre-to-Fibre matching

When using a partially spliced external cable, in internal variant 3 orders, all fibre should be clearly marked with the appropriate EBCL references.

In the case where there are multiple elements with the same colour, for example 288 Fibre, the Inner/Outer Jacket information should be clearly marked.

A set of Splicing Schedule templates can be found on the Ethernet Cablelink Product page under "Technical specifications": https://www.openreach.co.uk/cpportal/products/exchange-based-products/ethernet-cablelink

This contains 5 splicing schedules, covering 24, 48, 96, 144 & 288 fibre scenarios.

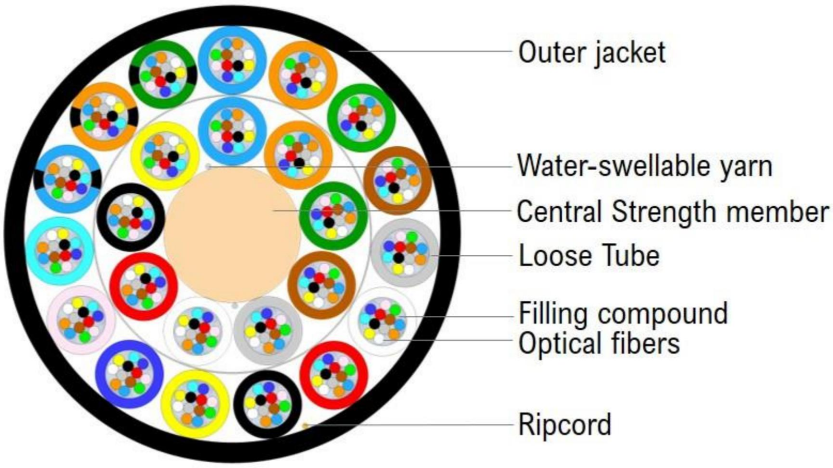


Figure 7 - COF200 288 Fibre

5. Internal Cable Termination Options

Openreach support two types of termination option, either left coiled by the designate rack or via an Openreach installed Patch panel.

5.1. Coiled Cable

When requested by a CP at the point of order, Openreach will leave the internal cable coiled with the area of the rack specified within the order. The coil of cable should be long enough to reach the bottom on the cabinet and left where there is space within the CPs Licenced Facility.

5.2. Optical Patching Shelves

If requested by a CP at point of order, Openreach will install patches in accordance with the business rules set within the Product Description.

Openreach support the following Optical Patch Panels:

- 1U high, 12 fibre SC/APC Connectors.
- 1U high, 24 fibre SC/APC Connectors.
- 1U high, 48 fibre SC/APC Connectors.

The Splice and Patch panel is designed to be installed into a 19” rack. Optionally, the Splice and Patch panel may be fitted instead into an ETSI 535mm rack.

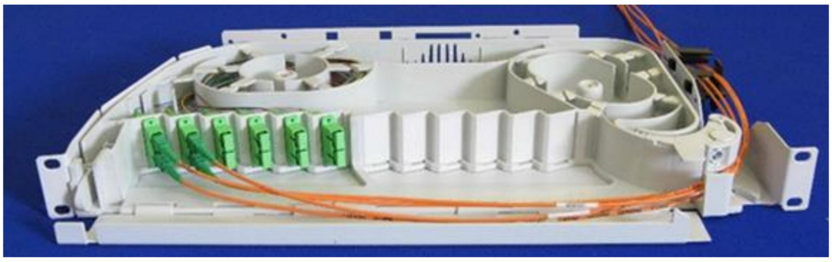


Figure 8 - 12 Fibre Patch Panel

6. Optical Fibre Acceptance Testing

Openreach will undertake reasonable endeavours to ensure splice losses are ≤0.3dB at 1310nm, in accordance with ITU-T L.12 Recommendation.

However, splice losses more than 0.3dB may be found if unidirectional measurements are taken with an OTDR. This is due to fibre characteristics, with the OTDR measuring backscatter of these and not the splice itself.

Unless otherwise stated all measurements shall be conducted at the nominal wavelengths of 1310nm and 1550nm.

These higher splice losses are acceptable providing that the overall optical performance of the route does not exceed the overall link loss budget.

Given Openreach does not have visibility of the overall link loss budget, an Ethernet Cablelink service will be considered faulty if:

- The CP bi-directional average of the OTDR readings for a splice are >0.3dB at 1310nm.

Openreach require bi-directional test results to be submitted by the CP in accordance with ITU-T L.12 Recommendation.

The bi-directional average is calculated using the methodology in ITU-T G.650.3.

CP measurements shall be made using a referenced Optical Power Meter (OPM) and Optical Light Source (OLS) at 1310nm and 1550nm. All measurements are to be in dB using the two-cord reference method (IEC and BS EN 61280-4-2).

PMD, CD and ORL analysis should be negotiated as part of the product contract.

6.1. Testing Connectivity

All test equipment connections to the fibres in the cable (ECS) shall be made using either:

- A pigtail cable and a temporary fusion splice.
- A patch cord to connect to the ECS via a terminating patch panel.

Prior to connection all optical connectors must be cleaned and inspected. For details of inspection procedures please refer to BS EN 61300-3-35. For details of cleaning procedures please refer to IEC/TR 62627-01.

An OTDR should be used to establish any high losses and the whereabouts of unplanned disconnections on the route.

6.2. Splice Loss Estimation

If Openreach has access to only one end of the fibre link then a uni-directional OTDR test can be completed. If Openreach require bi-directional test results then these will be submitted by the CP in accordance with ITU-T L.12 Recommendation, clause 5.6.

The below calculation should be used to calculate Bi-Direction Loss, see ITU-T G.650.3 for further details:

$$\frac{(\alpha_{A\rightarrow B} + \alpha_{B\rightarrow A})}{2}$$

Equation 1 - Average Splice Loss

All results must be compliant with this specification and recorded either electronically or on the Openreach template “Ethernet Cablelink Bi-Directional Testing Results Template” found here: https://www.openreach.co.uk/cpportal/products/exchange-based-products/ethernet-cablelink

7. Optical Safety

All transmission equipment connected to Openreach’s network must either incorporate sufficient safety features (ALS/APR/APSD) and/or not exceed Class 1M. This ensures the maximum optical power hazard level of accessible emission that Openreach people working on the network may be exposed to is no greater than Class 1M. As per:

- IEC 60825-2 2004 Safety of laser products — Part 2: Safety of optical fibre communication systems (OFCS)

All Visual Fibre Identifiers, aka, Visible Light Sources must adhere to Class 2 laser. As per:

- IEC 60825-1 2014 Safety of Laser Products – Part 1: Equipment classification and requirements, and must not exceed an optical power of 1mW

We expect CPs to confirm their adherence to this requirement as part of the establishment process.

Under no circumstances should laser power levels above those defined be applied to any part of the Openreach network. Higher optical powers present a significant risk to Openreach or CP's people working on the network. Any laser power levels identified as being above the agreed safe limit will be immediately isolated from the Openreach network on safety grounds. This may cause an interruption of service whilst an investigation takes place and may ultimately result in Openreach terminating the service.

8. Appendices

The following tables are referenced in this SIN.

8.1. Optical Fibre Presentation

Fibre 1	Blue
Fibre 2	Orange
Fibre 3	Green
Fibre 4	Red
Fibre 5	Grey
Fibre 6	Yellow
Fibre 7	Brown
Fibre 8	Purple
Fibre 9	Black
Fibre 10	White
Fibre 11	Pink
Fibre 12	Turquoise

Table 5 - Optical fibre identification (COF200, COF950 & COF401)

Tube	Identification / Colour
First tube	Red tube or the tube adjacent to red dummy tube
Last tube	Green tube or the tube adjacent to green dummy tube
Intermediate tubes	Uncoloured
Dummy tubes (not Marker/Reference tubes)	Yellow

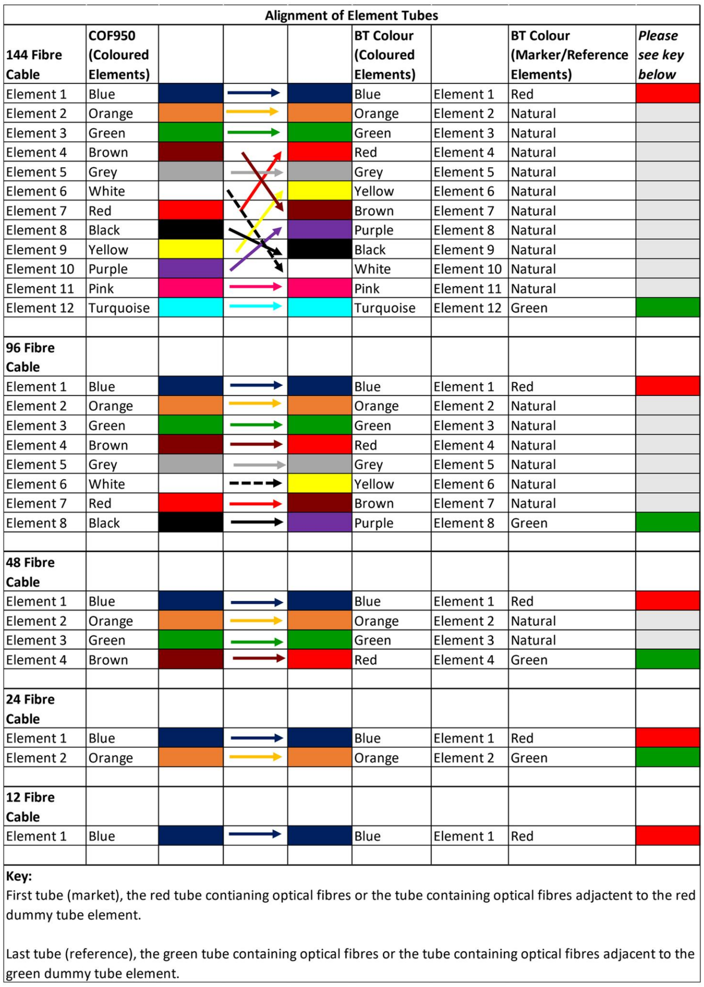
Table 6 - COF200 loose tube element identification

8.2. COF950 – discontinued internal cable

	COF950 12F	COF950 24F	COF950 48F	COF950 96F	COF950 144F
Central Strength Member	0.7mm glass reinforced plastic (GRP)			1.5mm GRP coated up to 2.5mm using Halogen-free flame-retardant thermoplastic material in accordance with BS EN 50290-2-27	1.6mm GRP coated up to 4.2mm using Halogen-free flame-retardant thermoplastic material in accordance with BS EN 50290-2-27
Optical Fibre	The cables contain primary coated single mode optical fibres in accordance with ITU-T Recommendation G.657.A.				
Optical Fibre Identification	The fibres in each tube are coloured for identification purposes. The fibres are coloured in accordance with Table 7 of this SIN.				
Stranded Layer (elements stranded around central strength member)	1 polymeric 'easy peel' blue tube containing 12 colour-coded fibres. The tube is 'dry', i.e. do not contain Gel type water blocking compound. There are 3 Polymeric dummy tubes.	2 polymeric 'easy peel' tubes (blue and orange) containing 12 colour-coded fibres. The tubes are 'dry'. There are 2 Polymeric dummy tubes.	4 polymeric 'easy peel' tubes (blue, orange, green, brown) containing 12 colour-coded fibres. The tubes are 'dry'. There are no Polymeric dummy tubes.	8 polymeric 'easy peel' tubes (in TIA colours) containing 12 colour-coded fibres. The tubes are 'dry'. There are no Polymeric dummy tubes.	12 polymeric 'easy peel' tubes (in TIA colours) containing 12 colour-coded fibres. The tubes are 'dry'. There are no Polymeric dummy tubes.
Loose Tube Identification	The colour scheme used for the loose tubes can be seen in Table 9 of this SIN.				
Binder/Wrapping Layer (material surrounding stranded layer)	There are no binder tapes/wrapping materials. A layer of e-glass fibres provides additional strength and further flame protection				
Ripcords	A single rip cord is found under the sheath				
Water blocking materials within cable	No materials present				
Cable Sheath Construction	Yellow Ultra Low Smoke Zero Halogen flame-retardant thermoplastic material in accordance with BS EN 50290-2-27.				
Cable Sheath Marking	Markings to indicate optical telecommunications cable + the legend COF950XXXF (XXX = Number of fibres in cable).				

Cable Outside Diameter	6.6 ±0.3mm	8.4 ±0.3mm	10.2 ±0.5mm
CPR Fire Performance	The cables meet the fire performance requirements of BS EN 50575 with a minimum classification of Cca s1b, d1, a2.		
Cable Jointing	The fibres are jointed using fusion splicing techniques. The cable joint closure (where applicable) is installed to the cable sheath using either mechanical or heat shrink techniques.		

Table 7 - COF950 properties (discontinued Internal Cable)



Alignment of Element Tubes								
144 Fibre Cable	**COF950 (Coloured Elements)**				**BT Colour (Coloured Elements)**		**BT Colour (Marker/Reference Elements)**	***Please see key below***
Element 1	Blue	🟦	→	🟦	Blue	Element 1	Red	🟥
Element 2	Orange	🟧	→	🟧	Orange	Element 2	Natural	⬜
Element 3	Green	🟩	→	🟩	Green	Element 3	Natural	⬜
Element 4	Brown	🟫	↘	🟥	Red	Element 4	Natural	⬜
Element 5	Grey	■	→	■	Grey	Element 5	Natural	⬜
Element 6	White	⬜	↘	🟨	Yellow	Element 6	Natural	⬜
Element 7	Red	🟥	↗	🟫	Brown	Element 7	Natural	⬜
Element 8	Black	⬛	↘	🟪	Purple	Element 8	Natural	⬜
Element 9	Yellow	🟨	↗	⬛	Black	Element 9	Natural	⬜
Element 10	Purple	🟪	↗	⬜	White	Element 10	Natural	⬜
Element 11	Pink	■	→	■	Pink	Element 11	Natural	⬜
Element 12	Turquoise	■	→	■	Turquoise	Element 12	Green	🟩
96 Fibre Cable								
Element 1	Blue	🟦	→	🟦	Blue	Element 1	Red	🟥
Element 2	Orange	🟧	→	🟧	Orange	Element 2	Natural	⬜
Element 3	Green	🟩	→	🟩	Green	Element 3	Natural	⬜
Element 4	Brown	🟫	→	🟥	Red	Element 4	Natural	⬜
Element 5	Grey	■	→	■	Grey	Element 5	Natural	⬜
Element 6	White	⬜	→	🟨	Yellow	Element 6	Natural	⬜
Element 7	Red	🟥	→	🟫	Brown	Element 7	Natural	⬜
Element 8	Black	⬛	→	🟪	Purple	Element 8	Green	🟩
48 Fibre Cable								
Element 1	Blue	🟦	→	🟦	Blue	Element 1	Red	🟥
Element 2	Orange	🟧	→	🟧	Orange	Element 2	Natural	⬜
Element 3	Green	🟩	→	🟩	Green	Element 3	Natural	⬜
Element 4	Brown	🟫	→	🟥	Red	Element 4	Green	🟩
24 Fibre Cable								
Element 1	Blue	🟦	→	🟦	Blue	Element 1	Red	🟥
Element 2	Orange	🟧	→	🟧	Orange	Element 2	Green	🟩
12 Fibre Cable								
Element 1	Blue	🟦	→	🟦	Blue	Element 1	Red	🟥

Key:

First tube (market), the red tube contianing optical fibres or the tube containing optical fibres adjactent to the red dummy tube element.

Last tube (reference), the green tube containing optical fibres or the tube containing optical fibres adjacent to the green dummy tube element.

Table 8 - COF950 loose tube jointing arrangement

8.3. Corrugated Steel Tube Cable diagram

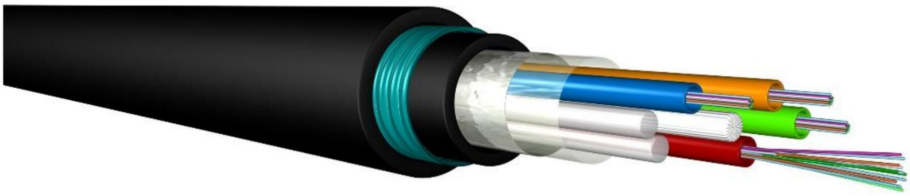


Figure 9 - Corrugated Steel Tape Cable (CST)

9. References

[1]	IEC 60825-1	Safety of laser products - Part 1: Equipment classification and requirements
[2]	ITU-T G.657	ITU-T Characteristics of a single-mode optical fibre and cable
[3]	ITU-T G.652	ITU-T Characteristics of a single-mode optical fibre and cable
[4]	BS EN 50290-2-27	Communication cables. Common design rules and construction. Halogen free flame-retardant thermoplastic sheathing compounds
[5]	BS EN 50575	Power, control and communication cables. Cables for general applications in construction works subject to reaction to fire requirements
[6]	ITU-T Rec. L.12	Optical fibre splices
[7]	ITU-T G.650.3	Test methods for installed single-mode optical fibre cable links
[8]	IEC and BS EN 61280-4-2	Fibre-optic communication subsystem test procedures - Single-mode attenuation and optical return loss measurement
[9]	BS EN 61300-3-35	Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements.
[10]	IEC/TR 62627-01	Fibre optic interconnecting devices and passive components. Fibre optic connector cleaning methods
[11]	COSHH	COSHH Regulations latest issue

Figure 1 - Ethernet Cablelink Schematic Diagram 6
Figure 2 - COF200 144 Fibre...7
Figure 3 - 12 incrementally bonded fibres..8
Figure 4 - Incrementally bonded ribbon cable 9
Figure 5 - COF401 48 Fibres (left) & 144 Fibres (right) 10
Figure 6 - Typical cable drop topology...13
Figure 7 - COF200 288 Fibre...14
Figure 8 - 12 Fibre Patch Panel 15
Figure 9 - Corrugated Steel Tape Cable (CST) 20

Table 1 - COF 200 properties (external cable) 7
Table 2 - COF 800 properties (external ribbon cable) 8
Table 3 - COF401 properties (Internal Cable) 10
Table 4 - COF401 loose tube element jointing arrangement 11
Table 5 - Optical fibre identification (COF200, COF950 & COF401) 17
Table 6 - COF200 loose tube element identification 17
Table 7 - COF950 properties (discontinued Internal Cable) 19
Table 8 - COF950 loose tube jointing arrangement...19

Equation 1 - Average Splice Loss..16

10. Abbreviations

APC	Angled Polished Connector
CP	Communications Provider
COF	Cable Optical Fibre
IPR	Intellectual Property Rights
OTDR	Optical Time-Domain Reflectometer
SC	Standard Connector
SIN	Suppliers Information Note
PIA	Physical Infrastructure Access
PMD	Polarization Mode Dispersion
CD	Chromatic Dispersion
ORL	Optical Return Loss